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(74) Agent: **WANG, Chen**; E.I. Du Pont de Nemours and Company, Legal Patent Records Center, 4417 Lancaster Pike, Wilmington, DE 19805 (US).

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(71) Applicant: **E.I. DU PONT DE NEMOURS AND COMPANY** [US/US]; 1007 Market Street, Wilmington, DE 19898 (US).

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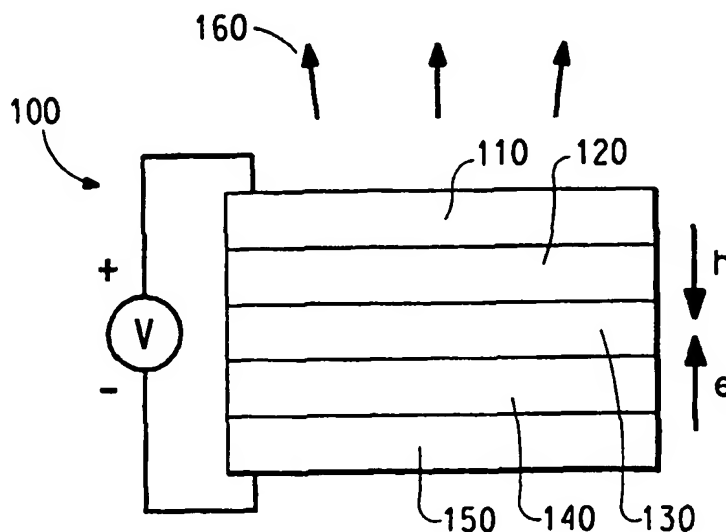
(72) Inventors: **PERIYASAMY, Mookkan**; 2623 Pennington Drive, Wilmington, DE 19810 (US). **GRUSHIN, Vladimir**; 533 Runnymede Road, Hockessin, DE 19707 (US). **PETROV, Viacheslav, A.**; 2 Cappa Court, Hockessin, DE 19707 (US). **HERRON, Norman**; 408 Apple Road, Newark, DE 19711 (US). **RADU, Nora, Sabina**; 109 Stoney Ridge Road, Landenberg, PA 19350 (US).

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(54) Title: **POLYMERS HAVING ATTACHED LUMINESCENT METAL COMPLEXES AND DEVICES MADE WITH SUCH POLYMERS**



(57) Abstract: The present invention is generally directed to a polymeric metal complex comprising a polymeric material having a plurality of a first-type functional groups, wherein at least a portion of the functional groups are coordinated to at least one metal containing complex, polymeric-metal complex salts comprising at least one polymeric material having a plurality of first-type functional groups having a charge, and at least one metal complex having an opposite charge. It further relates to devices that are made with the polymeric metal complex or the polymeric-metal complex salt.



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 01/31449

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H01L51/30

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H01L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

INSPEC, EPO-Internal, PAJ, CHEM ABS Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DONGXU ZHAO ET AL: "Organic light-emitting diode using Eu/sup 3+/ polymer complex as an emitter" JAPANESE JOURNAL OF APPLIED PHYSICS, PART 2 (LETTERS), 15 JAN. 1999, PUBLICATION OFFICE, JAPANESE JOURNAL APPL. PHYS, JAPAN, vol. 38, no. 1A-B, pages L46-L48, XP001086542 ISSN: 0021-4922 the whole document --- -/--	1-7, 15, 17, 21, 22, 29-32

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

\*Z\* document member of the same patent family

Date of the actual completion of the international search

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Königstein, C

## PCT/US 01/31449

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 01/31449

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WAI KIN CHAN ET AL: "LIGHT-EMITTING MULTIFUNCTIONAL RHENIUM (I) AND RUTHENIUM (II) 2,2'-BIPYRIDYL COMPLEXES WITH BIPOLAR CHARACTER" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 75, no. 25, 20 December 1999 (1999-12-20), pages 3920-3922, XP000902553 ISSN: 0003-6951 the whole document	27,28
X	SACKSTEDER L-A ET AL: "LONG-LIVED, HIGHLY LUMINESCENT RHENIUM (I) COMPLEXES AS MOLECULAR PROBES: INTRA- AND INTERMOLECULAR EXCITED-STATE INTERACTIONS" JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, AMERICAN CHEMICAL SOCIETY, WASHINGTON, DC, US, vol. 115, 1993, pages 8230-8238, XP000891821 ISSN: 0002-7863 the whole document	27,28

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 01/31449

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this International application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-8,15-22,29-32

Organic Light Emitting Diode Comprising an Polymeric Europium Complex

The prior art (D. Zhang et al. Jpn. J. Appl. Phys. 38 (1999) L46. (XP1086542)) describes an organic light emitting diode using an Eu<sup>3+</sup> polymer complex emitter.

The new features in claims 8,16,19-20 are the use of pyridine N-oxides as ligands for the Europium complex, as well as the use of co-polymers comprising (beside the Eu-complex) also hole transporting and/or light emitting moieties.

The special technical features as defined in rule 13(2) PCT, are pyridine N-oxides as ligands for the Europium complex, as well as the use of co-polymers comprising (beside the Eu-complex) also hole transporting and/or light emitting moieties.

The objective problem is to improve the efficiency of organic light emitting diodes comprising an polymeric europium complex.

2. Claims: 9,10,23,24

Polymeric Iridium Complex

The prior art (D. Zhang et al. Jpn. J. Appl. Phys. 38 (1999) L46. (XP1086542)) describes an organic light emitting diode using an Eu<sup>3+</sup> polymer complex emitter.

The new features in claims 9-10,23,24 are a polymeric iridium complex and it's use in a organic light emitting diode.

The special technical features as defined in rule 13(2) PCT, are a polymeric iridium complex and it's use in an organic light emitting diode.

The objective problem is to provide a polymeric iridium complex and it's use in an organic light emitting diode.

3. Claims: 11-14,25,26

Polymeric Aluminium Complex

The prior art (D. Zhang et al. Jpn. J. Appl. Phys. 38 (1999) L46. (XP1086542)) describes an organic light emitting diode

## FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

using an  $\text{Eu}^{3+}$  polymer complex emitter.

The new features in claims 11-14, 25, 26 are a polymeric aluminium complex and its use in an organic light emitting diode.

The special technical features as defined in rule 13(2) PCT, are a polymeric aluminium complex and its use in an organic light emitting diode.

The objective problem is to provide a polymeric aluminium complex and its use in an organic light emitting diode.

4. Claims: 27, 28

Polymeric Rhenium Complex

The prior art (D. Zhang et al. Jpn. J. Appl. Phys. 38 (1999) L46. (XP1086542)) describes an organic light emitting diode using an  $\text{Eu}^{3+}$  polymer complex emitter.

The new features in claims 27, 28 are a polymeric rhenium complex.

The special technical features as defined in rule 13(2) PCT, are a polymeric rhenium complex.

The objective problem is to provide a polymeric rhenium complex.



# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 01/31449

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
JP 2000204364	A	25-07-2000	NONE	
WO 0202714	A	10-01-2002	AU 7155001 A WO 0202714 A2	14-01-2002 10-01-2002
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